UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

MAR 16 2009

OFFICE OF
ENFORCEMENT AND
COMPLIANCE ASSURANCE

Mr. Francis Schwartz
GNEP PEIS Document Manager
Office of Nuclear Energy, NE-5
U.S. Department of Energy
1000 Independence Avenue, SW.
Washington, DC 20585

Dear Mr. Schwartz:

In accordance with our responsibilities under Section 309 of the Clean Air Act and the National Environmental Policy Act, the Environmental Protection Agency (EPA) has reviewed the Department of Energy's (DOE) Draft Global Nuclear Energy Partnership (GNEP) Programmatic Environmental Impact Statement (PEIS) (CEQ # 20080418).

The Advanced Energy Initiative has identified three ways to meet the challenge of generating more electricity: national and international nuclear energy activities; coal-based clean power and carbon sequestration; and renewable resources such as solar, wind, and geothermal power. As part of the initiative, the United States would work with other nations through the GNEP Program to develop and deploy advanced nuclear recycling and reactor technologies. DOE plans to advance these efforts by supporting the expansion of domestic and international nuclear energy production, while reducing the risk of nuclear proliferation and reducing the impacts associated with the disposal of future spent nuclear fuel. They plan to accomplish this by using either the existing fuel cycle or various alternative closed and open fuel cycles. While DOE has not selected a preferred alternative, their preference is a closed fuel cycle. Consequently, the proposed action for this draft PEIS is to close the nuclear fuel cycle. In a closed fuel cycle, spent nuclear fuel would be recycled, and some of the usable constituents would be made into new reactor fuel. The PEIS assesses the domestic programmatic alternatives that could achieve a closed fuel cycle, as well as some open-cycle alternatives. No specific proposed actions have been identified for the international component. The draft PEIS analyzes several alternatives, including open fuel cycle alternatives. The alternatives include:

1. No Action –Existing Once-Through Uranium Fuel Cycle
2. Fast Reactor Recycle Fuel Cycle Alternative
3. Thermal/Fast Reactor Recycle Fuel Cycle Alternative

4. Thermal Reactor Recycle Fuel Cycle Alternative
5. Once-Through Fuel Cycle Alternative Using Thorium
6. Once-Through Fuel Cycle Alternative using Heavy Water Reactors or High Temperature Gas-Cooled Reactors

These alternatives are not mutually exclusive and DOE could decide to pursue implementation of one or more of them.

Comments/Recommendations

General

- The environmental impacts of many of the alternatives discussed in the PEIS are difficult to evaluate comparatively because the projections used are based on conceptual models of the recycling technologies, and in some cases very limited full-scale operational experience for the power reactors and recycling facilities involved. EPA suggests that DOE conduct more research to fully characterize the environmental impacts of each of the alternatives. However, the PEIS does present sufficient information to support a conclusion that recycling would dramatically reduce the amounts of long-lived radionuclides in wastes that would require deep geologic disposal in the future.

- EPA understands that it was not the intent to evaluate any proposed actions or alternatives for the international component in this draft PEIS and therefore it was not a primary subject matter. However, it would be helpful if the text dealing with international aspects of the GNEP efforts explained how the effort would interface with established international activities and organizations charged with involvement and dissemination of nuclear technology. For example, what would the interface be between the GNEP program and International Atomic Energy Agency activities (safeguards for example) and responsibilities? Some discussion of these interfaces would be useful in putting the GNEP program within the larger context of international efforts.

- The draft PEIS identifies non-nuclear electricity production as an alternative, but does not provide an analytical technique that will be used for assessing the environmental impacts of the alternative in a comparative fashion. Carbon generation per unit of electrical power is a commonly used metric for such comparisons, but some assessment of environmental consequences of obtaining coal, gas or oil would also provide useful comparisons. EPA recommends that DOE consider identifying a programmatic environmental study that compares these alternatives to a subset of nuclear technologies.

- EPA believes that some of the "Alternatives Considered but Eliminated from Detailed Study" did not contain sufficient discussion to warrant their elimination. These alternatives include: the use of accelerators for transmutation, recycling high temperature gas-cooled reactor spent fuel and the use of breeder reactors. Some additional discussion would provide better support for their elimination.

Environmental Impacts of Mining and Manufacturing Reactor Fuels

- Uranium mine and mill discussions, in chapters 3, and 4 in particular, reference EPA's 1995 report on uranium mining, "Extraction and Beneficiation of Ores and Minerals". Instead, EPA recommends that DOE utilize information included in EPA's 2007 and 2008 reports: *Technologically Enhanced Naturally Occurring Radioactive Materials from Uranium Mining: Volume I Mining and Reclamation Background* and *Technologically Enhanced Naturally Occurring Radioactive Materials from Uranium Mining: Volume II, Investigation of Potential Health, Geographic, and Environmental Issues of Abandoned Uranium Mines,* both available at http://www.epa.gov/radiation/tenorm/pubs.html. We believe these documents would provide much more complete and up to date information, including risk assessments for use in the GNEP document. In addition, the 1983 report risk assessments in the EPA "Report to Congress Of The United States - Potential Health and Environmental Hazards of Uranium Mine Wastes" are outdated as to dose factors and other data; this has been addressed in Volume II of the new technical reports, referenced above.

Section 4.6. Once-Through Fuel Cycle Alternative Using Thorium (Thorium Alternative)

- EPA believes that this section does not clearly and fully describe the scope of impacts associated with increasing the extraction of thorium minerals versus uranium in the U.S. Thorium is primarily derived from monazite deposits in "fossil" heavy mineral beach sand deposits in Florida, Georgia, the Carolinas and Virginia. Many of these deposits have been mined and reclaimed for several decades, with the monazite sands returned to the ground due to their low value and radioactive character. Re-mining would disturb reclaimed lands including fragile coastal locations which may be subject to coastal zone management restrictions. New separation facilities may be necessary, including those which can concentrate the thorium metal, with resulting radium and other low-level waste disposal issues. For this reason, EPA believes the environmental impacts of a new thorium mining and processing industry need more assessment than has been provided. It would be useful to contrast the amount of thorium "ore" requiring processing to generate a given amount of reactor fuel (e.g., that needed to generate a fixed amount of electricity generation) with the amount of uranium ore needed to generate the same electricity generation level. It would also be useful to note that thorium extraction largely involves smaller scale excavations than some uranium mining methods, and mechanical processing of the ore rather than the

chemical processing involved in uranium leaching treatments, both above ground and in situ, thereby lowering environmental impacts from mining and processing.

EPA recommends that the discussion of thorium mining in Appendix A.3.2.1 be expanded to include discussion of the locations of monazite fossil beach heavy mineral sands in the eastern U.S., which could potentially be mined should the thorium reactor option be selected.

Since the thorium fuel cycle requires enriched uranium fuel, it would improve the assessments of impacts associated with mining and manufacturing reactor fuels to explain (and if possible provide some quantification of) the relative impacts from the combined uranium/thorium mining as contrasted against the uranium fuel cycle alone (the no-action alternative), particularly with respect to the areas mentioned above. In addition, in Tables 4.8 -1 to 4.8 – 6 for the 100, 150 and 200 gigawatt (GW) scenarios, the natural uranium feed entry (qualified in the column heading to include thorium) is the same for the thorium reactor option and the no-alternative option, but differs for the 400 GW scenario. It is not clear why this difference is to be expected or what it represents.

Environmental Impacts from Operation of the Power Reactors and Recycling Facilities

- A particular concern is that the waste projections in the draft PEIS from the operation of the various reprocessing technologies are projected from process designs rather than significant experience from full-scale operational experience.

  Although the PUREX process is eliminated from consideration because of non-proliferation concerns, experience with this process in the U.S. and abroad offers the best insight into waste production for full-scale operations. It would be useful for the draft PEIS to present information gathered for the PUREX experience for contrast against the projections from process diagrams and otherwise limited process experience for the other reprocessing schemes. This assessment could address two questions:

  1. Can the PUREX process be modified to eliminate the separation of plutonium and then used as a feed stream for MOX fuels? If this is possible, EPA believes such an alternative would be worth consideration because of the existing experience in using the PUREX process.

  2. Can the imposition of strict safeguard procedures effectively reduce proliferation concerns such that the PUREX process could still be considered as an alternative for the GNEP program, at least in the U.S.? There is a very significant base of operational experience in the U.S. and abroad with the

3. PUREX process, and therefore EPA believes projections of waste generation for this process would be more credible than the other processes described.

Environmental Impact of Wastes Disposal Issues

- The draft PEIS assumes that the Yucca Mountain repository will be available, but this assumption may not be correct. The document should make some comment on the implications for siting and licensing another deep geologic repository, and include the experience with Yucca Mountain in formulating time frames for implementation of the various options. The initiation of the search for a repository site predates the 1982 passage of the Nuclear Waste Policy Act and it has taken until 2008 for site selection, site characterization and preparation of a license application to occur. The draft PEIS should mention this history in discussions on how the time line for various alternatives would be affected since they all require some form of geologic disposal.

- For the recycling alternatives, the option of long-term storage (300 years) of separated cesium and strontium is briefly mentioned, with little discussion of the implications. This level of treatment implies the option is of little concern or potential impact. EPA does not believe this is the case. Storage of this highly radioactive material for such a time frame would be unprecedented and could involve issues concerning storage site selection, public acceptance, confidence building concerning active institutional controls over long time frames, facility engineering and safety concerns, transportation impacts and terrorism potential. While the PEIS may not be the place to treat these issues exhaustively, some mention of the difficulties in establishing the storage technology should be made , at least in terms of the impacts on projected time lines for establishing such a facility. It should be mentioned that it has taken over 25 years to get a repository site to the licensing stage and establishing a long-term storage facility for these high radioactive wastes could take a similarly lengthy period of time.

Transportation Impacts

- The No Action Alternative does not include the impacts of transportation of spent nuclear fuel to a geologic repository. Without including these risks, the comparative assessment of alternatives could be questioned, particularly since the transportation impacts to the Yucca Mountain site offers a point of reference derived from an actual transportation scenario.

  Since the locations and numbers of facilities needed for the various options is largely uncertain at this point, the assessments using a number of transportation distances is a reasonable way to generate some data for comparative purposes, despite the

uncertain nature of the assumptions. Incorporation of transportation safety experience abroad could also supply some data on the "real world" experience.

Treatment of Accident Scenarios in the PEIS

- An issue (in Appendix D) with all of the accident doses is that for many of the scenarios, the Maximally Exposed Individual (MEI) is reported to have a lifetime cancer risk of one (1), and a footnote states that the calculated dose is expected to result in acute health effects, up to death. EPA believes that the document does not include (or incorporate by reference) sufficient detail to discern the doses which would be acute (received within days) and those which would be chronic (received over the next 50 or 70 years). The MEI would most likely receive a combination of acute dose from the passing plume and radionuclides deposited on the ground in the vicinity and a chronic dose from radionuclides inhaled and deposited in the body, which would then irradiate the individual for many years into the future. This may lead to overestimation of the cancer risk for the MEI, when the dose is given as "400 rem" the latent cancer fatality (LCF) risk is given as 0.5 because there is a 50% chance of death from acute radiation syndrome. This presents a bleaker picture than would be calculated using the $6x10^{-4}$ LCF per rem used elsewhere in the document. The arithmetic would give about 2.4×10^{-1} or 24 % risk. By this same logic, in the document, all doses to the MEI above 900 rem are assigned an LCF risk of 1. In addition, all doses above 20 rem are automatically given a doubled risk coefficient (to remove the ICRP dose and dose rate effectiveness factor [DDREF]). Because of the lack of separation of acute and chronic doses, it is unclear that this is a correct method of doing the calculation. This methodology may also skew the relative cancer risk values of the various alternatives. The analyses would be more robust if the calculated doses were appropriately divided into acute and chronic, and the proper risk factors were used for each component. It is not clear if the various accident scenarios for the different reactors would have the same or different ratios of acute and chronic doses.

  The presentation would be more accessible if enough detail on the dose methodology were placed in the PEIS so that the decision maker and/or reader can understand how the dose estimates were made, in line with the comments above. In addition, EPA believes the accident doses cited above are very high, being well above estimates from historical information for accidents in the U.S. The presentation would be significantly improved if the accident scenarios leading to such doses were described in more detail.

  EPA believes the placement of collective dose estimates and latent cancer fatalities derived from collective dose estimates juxtaposed to similar estimates made for maximally exposed individuals (MEIs) leads to some very counter intuitive conclusions, i.e., where there are cancer fatalities noted for the collective dose

estimates but extremely small probabilities of a fatality for the MEIs. While this is a function of the statistical assumptions embedded in the calculation of collective dose and its application, the DEIS would benefit from a discussion in plain language that

compares the collective dose LCF numbers to equivalent calculations using natural background exposure levels to the same population base, or some fractions of them, as a point of comparison. EPA believes without such reference points for comparison, the understanding and utility of collective dose estimates and their potential role in decision making is unclear.

Intentionally Destructive Acts (Appendix B)

- Another scenario that should be considered in this section is deliberate malevolent acts to damage or drain wet storage spent fuel pools. Such acts could lead to releases if the pool was uncovered and there was sufficient residual decay heat to melt the stored fuel.

Dose Assessment Methodology

- EPA has identified several references and dose methodologies that were outdated. Some consideration should be given to incorporating more current information for these references/methodologies. They include:

    1. References switch from Gollnick (1988) to Cember (1996) to Shapiro (1990) for no obvious reason. All references cover the same material.
    2. Reference is made to US DHEW (1970), i.e. the Radiological Health Handbook, which has been out of print for many years.
    3. In C.1.1.3, a reference is made to Bland (1998) for acute effects of radiation whereas the International Commission on Radiological Protection (ICRP) 103 is a more recent source.
    4. Section C.1.1.4 references total effective dose equivalent (TEDE), whereas ICRP now use total effective dose (E). This section should be updated (also, section C.3).
    5. Section C.2 estimates cancer risk for healthy adult males. We suggest using FGR 13 to incorporate age-specific risk.
    6. Section C.4 should incorporate age specific dose and risk.

Based on the above issues we have rated the draft PEIS Environmental Concerns/Insufficient Information (EC-2), (see enclosed "Summary of EPA Rating System"). The EC rating is based on the potential for adverse impacts due to low-level waste disposal issues. The "2" indicates the draft PEIS does not contain sufficient information to fully assess the environmental impacts from the proposed action. With the exception of the no action alternative, this rating applies to each of the alternatives.

We appreciate the opportunity to review and comment on this document. If you have any questions you may contact me at (202) 564-5400. You may also call my staff point of contact, Marthea Rountree. She can be reached at (202) 564-7141.

Sincerely,

Susan E Bromm

Susan E. Bromm
Director
Office of Federal Activities

Enclosures (1): Summary of EPA Rating System